DOCUMENT RESUME

ED 209 266 TM 810 755

AUTHOR Harmon, David J.
TITLE Kanawha County Schools/West Virginia University Teacher Corps Project. Research Report.
INSTITUTION Kanawha County Schools, Charleston, W. Va.
PUB DATE 7 Jul 80
NOTE 55p.; Prepared through the Department of Research and Evaluation.

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS *Basic Skills; Computer Assisted Instruction; High Schools; *Intervention; *Mathematics Achievement; Pilot Projects; *Remedial Mathematics; *Secondary School Mathematics; *Student Attitudes
IDENTIFIERS Kanawha County Schools WV; Teacher Corps

ABSTRACT

The major problem in this study is to determine the effects of remedial methods on basic skills mathematics achievement and student attitude toward mathematics. Attitude prior to treatment was included as a blocking variable in one analysis. Remedial methods included: (1) no intervention or regular; (2) regular plus an intern teacher; (3) regular plus student use of a micro-computer; and (4) regular plus intern and micro-computer. Implementation of this Teacher Corps Project was with four teachers, four interns and all general mathematics high school students during the first nine weeks of the 1979-80 school year. This report is developed from a pilot research study perspective. The methods section includes a rather extensive discussion of techniques designed to support the internal validity of the study. The results are presented by hypothesis. Implications for teachers, project staff and administrators concerning the effects of micro-computer and intern utilization are limited to the application of each in this study. In addition to the discussion of implications, a summary of results and conclusions are presented in the final narrative section of this document. The appendices include documentation of various planning and monitoring procedures as well as instrumentation. (Author/GK)

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ED209266

Research and Evaluation Bulletin

TEACHER CORPS PROJECT

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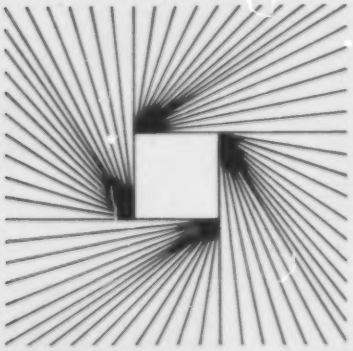

Kanawha County Schools

Department of Research and Evaluation

KANAWHA COUNTY SCHOOLS/WEST VIRGINIA UNIVERSITY

TEACHER CORPS PROJECT

RESEARCH REPORT

PREPARED BY

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July 7, 1980

Kanawha County Schools
Department of
Research and Evaluation
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ACKNOWLEDGEMENTS

The project staff and I sincerely thank the following teachers and principal for their cooperation, patience and assistance throughout the project:

1. Wanda Case - teacher;
2. Sara Joseph - teacher;
3. Nancy Slater - teacher;
4. Don Wilson - teacher; and
5. James Dillinger - principal.

I am also grateful to Joann Stevens, who typed this document in addition to her other duties.

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INTRODUCTION

The efficacy of alternatives for remedial mathematics instruction is of great concern to decision-makers as well as teachers. The need for this study is predicated by the lack of empirical information concerning mathematics remediation in Kanawha County. The major problem in this study is to determine the effects of remedial methods on basic skills mathematics achievement and student attitude toward mathematics. Attitude prior to treatment was included as a blocking variable in one analysis. Remedial methods included: (1) no intervention or regular; (2) regular plus an intern teacher; (3) regular plus student use of a micro-computer; and (4) regular plus intern and micro-computer. Implementation of this Teacher Corps Project was at Stonewall Jackson High School with four teachers, four interns and all general mathematics students during the first nine weeks of the 1979-80 school year.

This report is developed from a pilot research study perspective. Hence, the methods section includes a rather extensive discussion of techniques designed to support the internal validity of the study. The results are presented by hypothesis. Implications for teachers, project staff and administrators concerning the effects of micro-computer and intern utilization are limited to the application of each in this study. Therefore, the reader should not make overall judgments concerning the worth of micro-computers and/or interns for mathematics remediation. In addition to the discussion of implications, a summary of results and conclusions are presented in the final narrative section of this document. The appendices include documentation of various planning and monitoring procedures as well as instrumentation.

METHODOLOGY

This section includes a discussion of the following topics: (1) subjects and sampling; (2) mathematics content and treatments, (3) instrumentation; (4) data gathering and analysis; and (5) additional support for internal validity.

These topics were discussed in planning sessions prior to project implementation. The first group planning meeting was held at Stonewall Jackson High School on August 1, 1979. Documentation of this session is provided in Appendix A. Additionally, the mathematics teachers met for two days in August to identify course objectives and possible logistical impediments. Other meetings focused on use of the micro-computer.

Subjects and Sampling

Sophomores (N = 108) assigned to eight general mathematics (two groups per teacher) classes participated in the study. The number of students (cell size) was specific to each analysis due to missing data. Scheduling constraints prevented random assignment of subjects to treatment. Classes were randomly assigned to treatment. Teachers randomly drew numbers which corresponded to combinations of two types of remediation. The use of combinations prevented assigning both classes of a particular teacher to the same type of remediation. Hence, the confounding effects of differential teacher effectiveness was reduced. Subsequently, each of the four interns was randomly assigned to a class. Support for considering subjects rather than classes as the experimental unit is addressed under the final topic in this section.

Mathematics Content and Treatments

Mathematics Content. The general mathematics course at Stonewall Jackson High School stresses the acquisition of basic computational skills. It is recommended for students needing a concentrated study in basic mathematical operations as indicated by ninth grade standardized test results. The four participating teachers in consultation with the Kanawha County Mathematics Specialist decided to implement the Basic Computational Skills (BC 651 series) Educational Learning Packages for the duration of the study. The packages are a product of the Kanawha County Schools and include five books: (1) addition and subtraction of whole numbers; (2) multiplication of whole numbers; (3) division of whole numbers; (4) fractions; and (5) decimals and percent. Each book contains a list of materials, worksheets, tests, and activity and game sheets.

In order to adequately assess the effects of the alternative remedial methods, it was necessary to maintain the course content and teaching styles as constant. The use of packages and weekly planning meetings (teachers and interns) facilitated this critical aspect of the study. The Classroom Observation Record (Appendix B) and intern logs were used to determine the extent to which course content and teaching styles were standardized. Overall, the resulting data suggest that content and teaching styles were uniformly implemented. Additionally, each teacher was interviewed after the completion of the project using the Teacher Interview Instrument (Appendix C). The findings were generally supportive of the aforementioned results. Specifically, it was noted that eight formal planning meetings were held as well as informal

daily discussions. Most of the teachers (75%) rated the planning meetings as at least worthwhile.

Treatments. Four methods of remediation were implemented during the first nine week grading period (1979-80). The duration of the study was originally 12 weeks, however, two of the four interns left the program. Each level of the treatment was implemented by two different teachers (one class per teacher). This discussion serves to define each method both as planned and as implemented. The primary sources of the discrepancy information are the Teacher Interview Instrument (TII), the Weekly Micro-Computer Summary (WMS) and the Classroom Observation Record (COR).

Treatment #1 - Regular. The two classes assigned to the regular or traditional group experienced no special intervention. That is, the students were not exposed to the micro-computer and the teachers did not have the assistance of an intern. This group provides the standard by which the intervention groups were compared. Secondly, this group was the instructional foundation on which the other groups were built. The assignment of worksheets was the most frequent instructional method. Teacher 1 used worksheets during 85% of the total class time. About 40% of the total class time involved worksheets in the class taught by teacher #2. Teacher 2 used discussion and lecture more frequently than teacher #1.

Treatment #2 - Regular and Intern. The mathematics content and basic teaching styles for this group (two classes - one per teacher) were generally similar to treatment #1 with the addition of the assistance of an intern. Two of the four intern teachers were assigned to separate classes designated as treatment #2. The role of the intern was

a source of confusion throughout the study. The planned responsibilities of the intern included: (1) daily class attendance; (2) observation of the master teacher; (3) planning with the total mathematics department; (4) helping students individually or in small groups with mathematics assignments; and (5) completing non-instructional duties (maintaining records, grading papers). An average of 40% of the interns' total time in class was used to work with individual students. About 20% of total class time was used for grading papers. Other activities included administering tests (10%), maintaining records (5%), and observing the master teacher (25%). An estimated 15 class periods were missed by the two interns. Reasons for absences included: (1) substituting for other teachers; (2) illness; (3) meeting with the project director; and (4) job hunting.

As with treatment #1, the assignment of worksheets was the most frequently used instructional method. The students experienced worksheets during about 50% of the total class time.

Treatment #3 - Regular and Micro-computer. The mathematics content and basic teaching styles for this group (two classes - one per teacher) were generally similar to treatment #1 with the addition of student experiences with the micro-computer. The treatment #3 students were assigned to the micro-computer area for two twenty-minute sessions per week. The software for the Ohio Scientific Model (OSIC - 4P MF) Micro-computers was developed by consultant and coordinated with the Basic Computational Skills Packages. Project staff supervised the micro-computer area and provided a weekly summary of utilization. (Table 1).

TABLE 1

SUMMARY OF MICRO-COMPUTER UTILIZATION
FOR TREATMENT #3

Date	Group	# Students[a]	Hours on Computer	Diskette Used
9/17-21	1	9	2.25	Addition
		26	6.50	Multiplication
	2	12	3.00	Addition
		33	8.25	Multiplication
9/24-28	1	24	6.00	Multiplication
	2	8	1.75	Multiplication
		18	4.83	Division
10/1-5	1	15	3.35	Division
	2	12	3.50	Division
10/15-19	1	15	3.25	Fractions
	2	3	1.58	Fractions

[a] # Students: Each student was counted each time he/she arrived in the computer area.

Table 1 indicates a dramatic decrease in the total amount of computer time used by the students (i.e., from 20 hours to less than 5 hours). These data suggest severe implementation problems. The TII results state that between 25 and 50% of the students' scheduled computer time was lost due to micro-computer malfunction and scheduling (e.g., assemblies). Other factors contributing to the less than successful implementation of treatment #3 included: (1) teacher frustration; (2) unavailability of software at the appropriate time; (3)

negative attitude of some students; and (4) student absenteeism.

As with treatment #1, the assignment of worksheets was the most frequently used instructional method. The students experienced worksheets about 35% of the total class time. Since students reported to the micro-computer area at various times during a class period, the percentage of time used for lecture and giving directions was higher than that of treatments #1 and 2.

Treatment #4 - Regular, Intern and Micro-computer. The mathematics content and basic teaching styles for this group (two classes - one per teacher) were generally similar to treatment #1 with the addition of the assistance of an intern and student exposure to the micro-computer. The planned role of the intern was the same as in treatment #2. An average of 80% of the interns' total time in class was used to work with individual students. Other activities included administering tests (8%), grading papers (7%) and observing the master teacher (5%). It appears that the interns assigned to treatment #4 spent more time working with students and less time grading papers and observing than did the interns assigned to treatment #2. As with treatment #2, an estimated 15 class periods were missed by the interns. Reasons for absences included: (1) substituting for other teachers; (2) illness; and (3) conflicting responsibilities at a feeder junior high school.

Treatment #4 students were assigned to the micro-computer area for two twenty-minute sessions per week. Table 2 presents a summary of student utilization of the micro-computer.

TABLE 2

SUMMARY OF MICRO-COMPUTER UTILIZATION
FOR TREATMENT #4

Date	Group	# Students[a]	Hours on Computer	Diskette Used
9/17-21	1	8	2.00	Addition
		27	6.75	Multiplication
	2	9	2.25	Addition
		27	6.75	Multiplication
9/24-28	1	23	5.75	Multiplication
		14	3.42	Division
	2	12	3.00	Multiplication
		22	5.55	Division
10/1-5	1	16	4.13	Division
	2	19	4.67	Division
10/15-19	1	14	3.27	Fractions
	2	18	4.47	Fractions

[a] # Students: Each student was counted each time he/she arrived in the computer area.

As with treatment #3, treatment #4 student usage of the micro-computer decreased (i.e., from 17.75 hours to 7.74 hours). Teacher 1 noted that about 10% of the students' scheduled computer time was lost due to micro-computer malfunction and scheduling. Teacher 2 indicated that about 45% of the scheduled time was lost. The TII data suggest that students were positive, but not enthusiastic about using the micro-computer. Some students felt that the problems on the micro-computer were too easy. As with treatment #3, many factors contributed to the less than successful implementation of treatment #4.

About 45% of the students' class time was spent completing worksheets. This percentage is consonant with the percentages obtained for treatments # 1-3.

Instrumentation

The Basic Computation Skills Placement Test (BC) was administered as a pretest and posttest to assess changes in mathematics achievement. This 61 item instrument was developed by staff members of the Kanawha County Schools (March, 1976) and purports to measure such operations as addition, subtraction, multiplication, division, fractions, decimals and percent. The BC Test is articulated with the mathematics content taught during this study. Although the instrument is a criterion referenced test, there was no evidence of restriction of range or skewness. The BC Test showed KR-21 values of .84 (pretest) and .83 (posttest).

The Revised Math Attitude Scale (Aiken, 1963) was administered as a pretest and posttest to measure changes in attitude toward mathematics (Appendix D). This 20 item scale consists of 10 positive and 10 negative statements in a Likert scale format. A test-retest reliability coefficient of .94 was reported for this scale.

Data Gathering and Analysis

The Basic Computation Skills Placement Test and the Revised Math Attitude Scale were administered during the first and ninth weeks of the 1979-80 school year. All students assigned to the eight participating classes were asked to complete the instruments. The BC Test was scored by computer (Data Processing). The attitude scale was hand-scored by the Department of Research and Evaluation.

In order to test the effects of alternative remedial methods, the following analyses were performed: (1) t-test of related samples with both the pre/posttest achievement and attitude data at each treatment; (2) one-way analysis of covariance with achievement posttest data and one covariate (achievement pretest data); (3) one-way analysis of covariance with attitude posttest data and one covariate (attitude pretest data); and (4) two-way analysis of variance (pretest attitude scores were used as a blocking variable) with the posttest achievement data. When interactions were investigated, Dunn's method of multiple comparisons was employed. Correlation coefficients were computed to provide a source of explanatory information: (1) posttest achievement and posttest attitude scores; and (2) pretest and posttest achievement scores.

Additional Support for Internal Validity

Before attributing changes in achievement or attitude to a particular treatment, the following critical questions must be addressed: (1) were there significant differences in the means for mathematics achievement between types of remediation prior to treatment? and (2) were there significant differences in the means for mathematics attitude between types of remediation prior to treatment? A one-way analysis of variance (ANOVA) was performed with each criterion (pretest achievement and attitude scores). See Table 3.

TABLE 3

ANALYSIS OF VARIANCE OF PRETEST MATHEMATICS
ACHIEVEMENT BY ALTERNATIVE REMEDIAL TEACHING METHODS

Source	df	MS	F	F (Critical)
Teaching Methods (A)	3	129.08	1.74	2.72
Error (S/A)	91	74.25		
Total	94			

$p \leq 0.05$

No significant ($p \leq 0.05$) differences were obtained with the pretest mathematics scores. Hence, concern for the confounding effects of pretreatment mathematics achievement differences was reduced.

A second ANOVA was performed with the mathematics attitude data. See Table 4.

TABLE 4

ANALYSIS OF VARIANCE OF PRETEST MATHEMATICS
ATTITUDE SCORES BY ALTERNATIVE REMEDIAL TEACHING METHODS

Source	df	MS	F	F (Critical)
Teaching Methods (A)	3	140.50	0.70	2.73
Error (S/A)	80	201.03		
Total	83			

$p \leq 0.05$

No significant ($p \leq 0.05$) differences were obtained with the pretest attitude scores. Since no significant differences were found, concern for the confounding effects of pretreatment differences in attitude toward mathematics was lessened.

RESULTS

This section includes a discussion of the following: (1) differences between pretest and posttest means for each type of remediation; (2) differences in posttest means between types of remediation with the effects of pretreatment differences reduced; and (3) differences in achievement posttest means between types of remediation and levels of mathematics attitude. The tested hypothesis will be stated with each comparison. A summary of all results is provided at the conclusion of this section. Descriptive statistics for pre/posttest achievement and attitude scores are listed in Appendix E.

Differences Between Pretest and Posttest Means

The major purpose of the analyses in this subsection is to determine if significant changes in mathematics achievement and attitude occurred as a result of experiencing each treatment. Pretest and posttest scores were compared using the t-test of related samples.

Mathematics Achievement. The hypothesis that there are no significant differences between the pretest and posttest means at each type of remediation was rejected. The results of the t-tests of related samples are summarized in Table 5.

TABLE 5

PRETEST AND POSTTEST MEANS FOR MATHEMATICS ACHIEVEMENT BY ALTERNATIVE TEACHING METHODS

Treatments	Means		Difference	t	N
	Pretest (A)	Posttest (B)	(B-A)	Values	
Regular	32.24	40.80	8.56	6.51*	25
Intern Only	34.47	40.39	5.92	7.46*	36
Micro Only	37.43	40.95	3.52	2.99*	21
Intern & Micro	33.42	38.88	5.46	4.67*	24

*$p \leq 0.05$

Students assigned to each of the four treatments made significant ($p \leq 0.05$) improvements in mathematics achievement.

Attitude Toward Mathematics. The hypothesis that there are no significant differences between the pretest and posttest means at each type of remediation was rejected at treatment #3 (micro-computer only) and treatment #4 (intern and micro-computer). The results of the t-tests of related samples are summarized in Table 6.

TABLE 6

PRETEST AND POSTTEST MEANS FOR ATTITUDE TOWARD MATHEMATICS BY ALTERNATIVE TEACHING METHODS

Treatments	Means		Difference	t	N
	Pretest (A)	Posttest (B)	(B-A)	Values	
Regular	69.52	72.72	3.20	1.58	25
Intern Only	66.29	68.13	1.84	0.96	31
Micro Only	70.36	65.50	-4.86	1.94*	14
Intern & Micro	65.85	73.90	8.05	3.39*	20

*$p \leq 0.05$

Table 6 indicates that: (1) attitude toward mathematics significantly ($p \leq 0.05$) decreased among students assigned to treatment #3 (micro-computer only); and (2) attitude significantly ($p \leq 0.05$) increased among treatment #4 (intern & micro-computer) students.

Effects of Remedial Methods

The computations in this subsection provide a comparison between and among the four methods of remediation. Posttest treatment means were compared using a one-way analysis of covariance design (ANCOVA).

Mathematics Achievement. The hypothesis that there are no significant differences in the adjusted means for mathematics achievement between types of remediation was not rejected. The ANCOVA results are presented in Table 7.

TABLE 7

ANALYSIS OF COVARIANCE FOR MATHEMATICS ACHIEVEMENT BY ALTERNATIVE REMEDIAL TEACHING METHODS

Source	df	MS	F	F (Critical)
Teaching Methods (A)	3	62.00	2.21	2.71
Error (S/A)	101	28.10		
Total	104			

$p \leq 0.05$

No significant ($p \leq 0.05$) differences were obtained in the posttest means for mathematics achievement. Hence, no remedial method was better than other tested methods in improving mathematics achievement. Adjusted cell means are presented in Table 8.

TABLE 8

ADJUSTED CELL MEANS[a] FOR MATHEMATICS ACHIEVEMENT BY ALTERNATIVE REMEDIAL TEACHING METHODS

	Treatments			
	Regular	Intern Only	Micro Only	Intern & Micro
Means	42.40	40.25	38.50	40.53

[a]Adjusted cell means: Calculated using pretest mathematics achievement scores.

Attitude Toward Mathematics. The hypothesis that there are no significant differences in the adjusted cell means for attitude toward mathematics between types of remediation was rejected. The ANCOVA results are presented in Table 9.

TABLE 9

ANALYSIS OF COVARIANCE FOR ATTITUDE TOWARD MATHEMATICS BY ALTERNATIVE REMEDIAL TEACHING METHODS

Source	df	MS	F	F (Critical)
Teaching Methods (A)	3	439.05	4.17*	2.74
Error (S/A)	85	105.41		
Total	88			

*$p \leq 0.05$

Table 9 indicates that a significant main effect ($p \leq 0.05$) resulted for the mathematics attitude posttest. Adjusted cell means are provided in Table 10.

TABLE 10

ADJUSTED CELL MEAN COMPARISON MATRIX OF MATHEMATICS ATTITUDE POSTTEST SCORES BY ALTERNATIVE REMEDIAL TEACHING METHODS

		Remedial Methods			
Absolute Diff.		Regular	Intern Only	Micro Only	Intern & Micro
Adjusted Means		71.08	69.43	63.10	75.60
Regular	71.08		1.65	7.98	4.52
Intern Only	69.43			6.33	6.17
Micro Only	63.10				12.50*
Intern & Micro	75.60				

*$p \leq 0.05$

The significant main effect ($p \leq 0.05$) suggests that students assigned to treatment #4 (intern & micro-computer) had a more positive attitude toward mathematics than students assigned to treatment #3 (micro-computer only). Other comparisons presented in Table 10 yielded no significant differences.

Effects of Remedial Methods and Mathematics Attitude

The analysis presented in this subsection examines the possibility that students' attitude toward mathematics affects the efficacy of remedial methods in enhancing mathematics achievement. Additionally, main effects for remedial methods and attitude are assessed with the mathematics posttest. Students were designated as either high attitude (HA) or low attitude (LA) relative to the distribution of the pretest attitude scores for each treatment.

A two-way analysis of variance design was used to test three hypotheses. The results are as follows:

1. The hypothesis that there is no significant two-way interaction in the means for mathematics achievement between types of remediation and attitude was rejected.

2. The hypothesis that there are no significant differences in the means for mathematics achievement between levels of attitude toward mathematics was rejected.

3. The hypothesis that there are no significant differences in the means for mathematics achievement between types of remediation was not rejected.

Table 11 presents the computational findings for the two-way analysis of variance.

TABLE 11

ANALYSIS OF VARIANCE FOR MATHEMATICS ACHIEVEMENT BY ATTITUDE AND ALTERNATIVE REMEDIAL TEACHING METHODS

Source	df	MS	F	F (Critical)
Attitude (A)	1	309.38	4.79*	3.97
Methods (B)	3	12.86	0.20	2.73
A X B (AB)	3	240.79	3.73*	2.73
Error (S/AB)	80	64.54		
Total	87			

*$p \leq 0.05$

Inspection of Table 11 indicates that both a two-way interaction and an attitude main effect resulted with the mathematics posttest scores. The two-way interaction precludes serious consideration of the main effect for attitude. Cell means are provided in Table 12.

TABLE 12

CELL MEANS FOR MATHEMATICS ACHIEVEMENT
BY ALTERNATIVE REMEDIAL TEACHING METHODS AND ATTITUDE

Remedial Methods	Attitude Toward Math High	Low	Difference (High - Low)
Regular	43.18	36.09	7.09
Intern Only	39.88	41.06	-1.18
Micro Only	46.29	31.71	14.58*
Intern & Micro	39.10	38.70	0.40

*$p \leq 0.05$

The two-way interaction occurred at treatment #3 (micro-computer only) in which high attitude students were more successful than the low attitude students on the basic computational skills measure; see Figure 1.

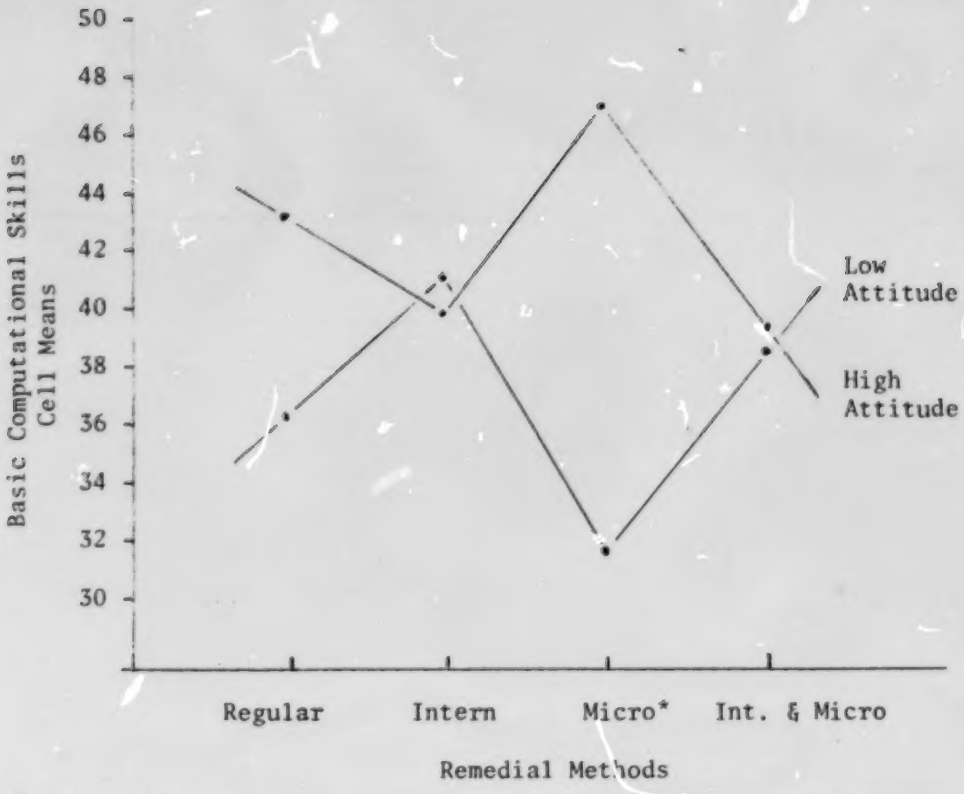

Figure 1. Interactive Effect of Remedial Methods by Attitude on the Basic Computation Skills Test (Mathematics Achievement).

*Significant $p \leq 0.05$

Summary of Results

Table 13 provides a listing of all findings.

TABLE 13

SUMMARY OF FINDINGS

Comparison	Tests of Significance[a]	Post-hoc Analysis
Posttest with Pretest		
Math achievement		
Treatment #1 (Regular)	Post > Pretest	
Treatment #2 (Intern Only)	Post > Pretest	
Treatment #3 (Micro Only)	Post > Pretest	
Treatment #4 (Intern & Micro)	Post > Pretest	
Attitude Toward Math		
Treatment #1 (Regular)	NSD[b]	
Treatment #2 (Intern Only)	NSD	
Treatment #3 (Micro Only)	Pre > Posttest	
Treatment #4 (Intern & Micro)	Post > Pretest	
Effects of Remedial Methods		
Math Achievement	NSD	
Attitude Toward Math	$p \leq 0.05$	
Treatment #3 with #4	$p \leq 0.05$	Treatment #4 > #3
Effects of Methods (M) and Attitude (A)		
Math Achievement		
Methods X Attitude	$p \leq 0.05$	HA > LA at Treatment #3
Methods - Main Effects	NSD	
Attitude - Main Effects	$p \leq 0.05$	HA > LA

[a]Tests of Significance: 0.05 level used for all comparisons.
[b]NSD: No significant difference.

The results suggest that students assigned to all four treatments made significant gains in mathematics achievement. However, no single method of remediation was better than other methods in facilitating such gains. Students that experienced treatment #4 (intern and micro-computer) had significantly better posttest attitude scores than the students that were exposed to treatment #3 (micro-computer). The attitude of treatment #4 students significantly increased during the project, while treatment #3 students showed a significant decrease in attitude toward mathematics. High attitude students had significantly better mathematics achievement scores than low attitude students when assigned to treatment #3.

DISCUSSION

The major problem in this study was to determine the effects of remedial methods on basic skills mathematics achievement and student attitude toward mathematics. Secondly, to assess the effects of remedial methods and attitude on mathematics achievement. Before making conclusions based on the statistical findings, the adequacy of the implementation of the remedial methods must be addressed. Hence, this section provides a rather extensive discussion of treatment implementation and implications for future use of the tested methods. The final subsection presents a summary of results and conclusions.

Implementation of Treatments

Several procedures were utilized to reduce the potentially confounding effects of the following sources of invalidity: (1) differential teacher and intern effectiveness; (2) differences in mathematics content and teaching styles; (3) pretreatment differences in computational skills; and (4) pretreatment differences in attitude toward mathematics. The procedures included: (1) random assignment of classes to treatment, such that no teacher was assigned to both sections of a particular treatment; (2) random assignment of interns to treatment; (3) utilization of the Basic Computational Skills Educational Learning Packages and regular planning sessions to standardize mathematics content and teaching styles; and (4) covariation to reduce pretreatment differences in mathematics achievement and attitude. It was statistically determined that there were no significant differences in mathematics achievement and attitude among the treatment groups prior to treatment.

The data generated from the Classroom Observation Record suggested that mathematics content and teaching styles were similar across the treatments. However, Teacher Interview Instrument and the Weekly Micro-computer Summary data indicated major implementation problems with treatments #2-4. The uncertainty concerning the role of the intern and intern absenteeism reduced the credibility of treatment #2 and 4. Micro-computer malfunction, unavailability of software and scheduling confounded the implementation of treatment #3 and 4. Teacher Interview Instrument data suggested that classes assigned to treatment #3 may have been more severely affected by the aforementioned problems than treatment #4 classes. A fourth period and a fifth period class were assigned to treatment #4. A first period class and a seventh period class were assigned to treatment #3. Some micro-computer malfunctions that affected the first period class were corrected by fourth period. School assemblies were typically held during early morning classes. Student absenteeism was relatively high in the seventh period class.

Implications. A pilot study serves to identify implementation problems as well as resolve anticipated difficulties. In order to test the effects of interns assisting master teachers, the role of the intern must be clearly defined and understood by both the interns and the master teachers. Secondly, the interns should be encouraged to maintain good attendance. Interns should not be asked to substitute for other teachers or meet with the project director during assigned class time.

It seems that the major impediment to the adequate implementation of treatment #3 and 4 was software. Unfortunately this problem is rather common among projects which include micro-computers. Ideally, all teachers and interns would have had an opportunity to review the

diskettes prior to the beginning of the study. Perhaps project staff members should have received training in micro-computer maintenance.

Summary of Results and Conclusions

Summary of Results. Significant gains in mathematics achievement were made by students assigned to all four treatments. When comparisons were made between remedial methods, no significant differences in post-test mathematics scores were obtained. This finding was expected considering the level of implementation of treatments #2-4.

Posttest attitude scores of treatment #4 students (intern and micro-computer) were significantly higher than the scores of treatment #3 (micro-computer only) students. This finding may be partially explained by the following: (1) the interns facilitated the transition from classroom to micro-computer area as well as instruction; (2) treatment #4 classes (fourth and fifth period) experienced fewer micro-computer malfunctions and scheduling problems; and (3) attitude scores of treatment #4 students significantly increased, while treatment #3 students showed a significant decrease in attitude scores.

High attitude students assigned to treatment #3 (micro-computer only) had significantly better mathematics achievement scores than low attitude students assigned to treatment #3. Other comparisons between high and low attitude students yielded no significant differences.

Conclusions. There appears to be some support for the following conclusions:

1. Overall, students made significant gains in basic computational skills.

2. Judgments concerning the worth of the micro-computer as an instructional tool cannot be made due to implementation problems.

3. The effects of intern assistance on remediation in mathematics cannot be accurately assessed by this research due to questions concerning treatment implementation.

4. Attitude toward mathematics is an important factor in the acquisition of basic computational skills.

Although implementation difficulties prevented the resolution of the major research problem, some positive outcomes were noted. They included: (1) the development of software; (2) an increase in the frequency of departmental planning; (3) the experience gained by the participating teachers in using the Basic Computational Skills Educational Learning Packages; and (4) the identification of some of the prerequisites for successfully utilizing the micro-computer.

BIBLIOGRAPHY

Aiken, L. R. "Personality Correlates of Attitude Toward Mathematics," Journal of Educational Research, LVI (1963), 576-580.

APPENDIX A

DOCUMENTATION OF PRELIMINARY
PLANNING MEETING

Prepared by
Project Staff

KANAWHA COUNTY SCHOOLS/WEST VIRGINIA UNIVERSITY

TEACHER CORPS PROJECT

DOCUMENTATION

Planning for Teacher Corps Mathematics Experimental Teaching/Learning Design

Place of Meeting: Stonewall Jackson Conference Room
Date: August 1, 1979
Purpose: To plan an evaluation design which will assess effects of interns and intervention teaching strategies for improving instruction and achievement in general mathematics high school course.

Persons Attending Meeting:

Mr. James Dillinger - Principal, Stonewall Jackson High School
Dr. David Harmon - Research Department, Kanawha County Schools
Ms. Jean Hall - Mathematics Specialist, Kanawha County Schools
Ms. Carolyn Dorcas - Teacher Corps Team Leader
Ms. Katy Maddox - Teacher Corps Director
Ms. Wanda Case - Teacher at Stonewall Jackson High School
Ms. Nancy Slater - Teacher at Stonewall Jackson High School
Ms. Sara Joseph - Teacher at Stonewall Jackson High School
Mr. Don Wilson - Teacher at Stonewall Jackson High School

This was the first planning session for the group of mathematics teachers at Stonewall Jackson High School to meet together with the specialists and Teacher Corps staff in order to discuss a possible evaluation design in mathematics which would help improve teacher effectiveness and look at achievement gains for students in general mathematics using a variety of interventions.

The Project Director, Katy Maddox, had contacted each of the teachers individually to talk with them about participation in the proposed research design which would be implemented the first twelve weeks of the fall semester 1979. The four math teachers were very receptive to coming together for the meeting and discussing the possibility of improving the general mathematics course at Stonewall Jackson High School, which may serve as a model for other schools within Kanawha County.

Nancy Slater, a teacher at Stonewall Jackson, had participated in a summer workshop with Jean Hall, County Mathematics Specialist, in helping to revise the Kanawha County skills sequence for general mathematics. A number of new materials were produced and sequenced according to basic skills areas of addition; subtraction; multiplication; division; percentage; fractions and decimals.

Dr. Harmon first presented an overview of the plan for the evaluation design. He stressed that this was not to test one teacher effect against another teacher effect. He emphasized that the design would reduce the differential effects of teachers. The purpose of the design would be to test the effect of

interns in the classroom and to determine the effect of an extra intervention (micro-computers) which would be used as a part of the design since this is a component of the Kanawha County/West Virginia University Teacher Corps Project objectives.

A detailed description prepared by Dr. Harmon is attached which gives the variables for the study and identifies the specific tests which will be used for the design.

After Dr. Harmon presented the overall design, teachers interacted freely with him asking what their specific role would be, and helped to establish that role. Secondly, they preceeded to discuss the role of the intern in the classrooms where interns would be placed.

Jean Hall, County Specialist, next worked with the four teachers to help them establish instructional priorities for the first twelve weeks of school. She related the task of making detailed lesson plans in order to reduce the teacher variables in the study. All teachers will follow identical lesson plans and will meet once a week to have indepth planning sessions. Interns will be included in these planning sessions and will have a significant role in the overall design of the research study. Jean Hall also stated she would be glad to work with the teachers and to provide support services for them as they planned the twelve week lessons in basic skill areas. The four teachers agreed they would like to use the Kanawha County basic skills which had been sequentially developed, coded and for which criterion-referenced tests are being designed. The teachers and interns will have input into further developing and refining the basic skills instructional materials.

Teachers next randomly drew numbers to see which teacher would be matched with a regular classroom and/or a classroom with intern and/or classroom with micro-computer and/or classroom with intern plus micro-computer. In order to further reduce intern effects, the interns will rotate after the first six weeks in order to work with a second teacher for the second six weeks term.

Dr. Harmon has consented to document and write the detailed procedures for the evaluation design. Carolyn Dorcas, Team Leader, will be trained to make observations in the classroom to record on task behavior of students and to record activities within each of the eight mathematics classes in order to verify there is consistency among the teachers in following the specific objectives as determined by the group.

A monitor will also be identified to help schedule and oversee the use of the micro-computers by the students.

At the end of the three hour meeting teachers expressed statements that they felt the preliminary planning before the opening of school and the weekly planning by the mathematics department would greatly improve the quality of instruction in the general math courses. They were all eager to participate in the evaluation study and stated they would be willing to work and plan together with the interns and were also willing to have interns and persons present to monitor the classroom activities during the first twelve weeks of school.

As the meeting was adjourning, the teachers agreed to meet for two full days on August 2 and August 3 in order to plan together, to identify objectives for the first twelve weeks, to identify learning activities which would be commonly used in the eight general math courses and to further plan the role of the interns in the instructional process.

A follow-up meeting of all persons present is planned for late August with the four interns in order to finalize the evaluation design and to finalize the role of the intern in working with mathematics basic skills classes.

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CONCERNS EXPRESSED BY TEACHERS

1. The four mathematics teachers from Stonewall expressed concern about the wide range of abilities students would have in the general math course. They were apprehensive as to how they could provide for individual needs of students at both the lower end and upper end of the spectrum.

2. Teachers also expressed concern over attendance. They stated that absences are a most important factor. They recommended that a very careful attendance record be kept. Along the same line they expressed some concern over assemblies and pep rallies which would be called during the first twelve weeks of school as that would be the football season. Mr. Dillinger, principal, stated he would be glad to work with the Teacher Corps Project in order to rotate the time for the pep assemblies in order that one classroom would not be affected more than others.

3. Teachers expressed concern over the amount of homework which would be given. Dr. Harmon stated all teachers must be consistent in their planning and in the amount of homework assignments given.

4. Teachers also stated concern over when to test and concern for all teachers to give tests on the same day. Dr. Harmon assured the teachers this would work out quite well.

5. Teachers were rather confused about "where to begin". This was resolved by teachers stating they would first list the skills and the skill clusters to be developed during the first twelve weeks. Secondly, they would list activities, worksheets, games and other forms of instruction. It was stated that the four teachers would try to change pace in the mathematics classes every fifteen minutes.

6. Concern was expressed over consistency for remediation. It was decided that worksheets would be prepared for both the slow learners and for excellerated learners in skill clusters by the four teachers as a group. Teachers would then be consistent in their assignments for both remediation and for excelleration.

7. Concern was expressed over the amount of extra time teachers would have to spend meeting and planning after school. They were also very concerned over the scheduling of students' use of micro-computers. It was decided that the students would use micro-computers during class time at 20 minute intervals, twice a week. They felt if the student was permitted to use the micro-computer after class or during study hall this would contaminate the research data because it would provide certain students with extra instructional time. Therefore, all persons present agreed to schedule the use of the micro-computer during the regular classroom schedule. It was also agreed by everyone present that tutoring should not be implemented in the overall evaluation design for the first twelve weeks. Again the reason being that this would further contaminate the data and it would be very difficult to isolate the effect of the interns or the micro-computer on the students in the general math class. It was suggested that perhaps after the evaluation

study was completed, that tutoring might be encouraged for second semester with those students in the general math class.

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APPENDIX B

CLASSROOM OBSERVATION RECORD

CLASSROOM OBSERVATION RECORD (COR)

All classes participating in study should be observed on the same day at least once a week. When classes meet at the same time, the observation time should be split such that each class is observed. These data along with the daily logs of the interns will provide an assessment of the consistency of the project's implementation across treatments.

I. Demographic

Date _____ Teacher _____ Time In _____
Period _____ Intern _____ Time Out _____
Project Code _____ Observer _____ # Students _____

II. Objective #(s) _____

List the Topics (e.g., addition of whole numbers)	Amount of Time/Minutes (e.g., 8 minutes)
1.	
2.	
3.	
4.	

III. Methodology (Regular Teacher)

Methods	Amount of Time/Minutes
1. Questioning	
2. Lecture	
3. Discussion	
4. Testing	
5. Worksheets	
6. Problem on Board	
7. Reading	

8. Working Book Problems

9. Individualizing

10. Small Groups

11. Others, Please Speficy;

a. _____

b. _____

c. _____

IV. Role of Intern

Indirect Teaching Functions	Amount of Time/Minutes
1. Grading Papers	
2. Keeping Records	
3. Handing Out Papers	
4. Observation	
5. Others, Please Specify	
a. _____	
b. _____	
c. _____	

Direct Teaching Functions	Amount of Time/Minutes
1. Questioning	
2. Lecture	
3. Discussion (Entire Class)	
a. Leading	
b. Participating	
4. Testing	
5. Problem on Board	
6. Individualizing	

7. Small Groups

8. Others, Please Specify

a. _____

b. _____

c. _____

V. Percentage of students attending class during observation _____ %

VI. Treatments that include 3 interns, others delete:

1. Both teacher and intern present throughout the observation period.

_____ Yes _____ No

If No, complete items 2 and 3. If yes, stop.

2. Amount of time intern out of the class _____ minutes.

3. Amount of time teacher out of the class _____ minutes.

NOTE TO THE OBSERVER: Dimensions I-VI should be consistent for each observation day. Any inconsistencies should be discussed during the weekly planning meetings. If the inconsistencies persist, the project director and researcher should be advised. If the COR and the interns' logs are not consistent, then the observer and the intern should discuss the deviation(s). Questions concerning the appropriate use of this instrument should be addressed to Dr. David Harmon.

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APPENDIX C

TEACHER INTERVIEW INSTRUMENT

TEACHER CORP PROJECT - TEACHER INTERVIEW INSTRUMENT

Name _____ Treatment Group ____ Period _____

Intern's Name _____ ____ Period _____

I. All Groups

A. Standardization of Content

(Total) ___ 1. Number of group planning meetings including:
___ a. All teachers and all interns
___ b. All teachers and 2 or 3 interns
___ c. All teachers and zero interns
___ d. One or more interns and teachers absent

___ 2. Frequency of informal discussions

___ 3. Worth of planning meetings in standardizing content of daily/weekly lessons?

A	B	C	D
Very Worthwhile	Worthwhile	Not Very Worthwhile	Not Worthwhile at all

___ 4. Number of times you or your intern was observed by a Teacher Corp staff member.

B. Standardization of Instructional Methodology

___ 1. Describe a typical class format (organization of events) for: "Step-by-Step"

a. Level of Independent Variable _____

b. 2nd Level of the Independent Variable _____

___ 2. What differences in methods and/or content existed between your two classes participating in the study? _____ None - continue.

___ 3. Over the duration of the study, estimate the percentage of total class time that your students experienced (Specify for each level of the treatment):

	A Regular	B Intern	C Micro	D Int. + Micro
a. Questioning	____	____	____	____
b. Lecture	____	____	____	____
c. Discussion	____	____	____	____
d. Testing	____	____	____	____
e. Worksheets	____	____	____	____
f. Board Problems	____	____	____	____
g. Reading	____	____	____	____
h. Book Problems	____	____	____	____
i. Individualizing	____	____	____	____
j. Small Groups	____	____	____	____
k. Others, Specify	____	____	____	____

____ _____

____ _____

____ _____

C. Assessment of the Project

___ 1. Grade effects on student achievement

A B C D E

___ 2. Grade effects on student attitude toward math.

A B C D E

___ 3. List two greatest strengths

a.

b.

___ 4. List two greatest weaknesses

a.

b.

___ 5. General comments:

II. Intern and Micro + Intern Only

A. Role of the Intern

___ 1. Number of days/week the intern was scheduled into your class?

___ a. Number days (class period) in your class

___ b. Number days absent from your class.

___ 2. Reasons for absences

a.

b.

___ 3. Describe the role of the intern during a typical class period.

___ 4. Over the duration of the study, estimate the percentage of total class time that your intern (Specify for each level of the treatment) (present only) involved in:

	A Intern	B Int. + Micro
Grading Papers	____	____
Questioning Students	____	____
Lecturing	____	____
Small group	____	____
Total class	____	____
Discussion	____	____
Leading	____	____
Participating	____	____
Testing	____	____
Working Problems on Board	____	____
Working with Individual Students	____	____
Keeping Records	____	____
Observation	____	____
Your Class	____	____
Other Classes	____	____
Others, Specify	____	____

____ _____

____ _____

____ _____

III. Micro and Micro + Intern Only

A. Number of days/week your students (each) were scheduled with the micro.

___ 1. Estimate total hands-on the micro time per student per week.

___ 2. Estimate the percentage of time that your students were scheduled to use the micro, but could not due to malfunction or scheduling (e.g., assembly)

B. Students' reaction to the micro

C. Usefulness of micro in improving:

___ 1. Achievement

Very Useful	Useful	Not Very Useful	Not Useful at All
A	B	C	D

___ 2. Attitude toward math

APPENDIX D

REVISED MATH ATTITUDE SCALE

Name_____

Teacher's Name_____

Date_____

REVISED MATH ATTITUDE SCALE (AIKEN, 1963)

DIRECTIONS: Please write your name in the upper right hand corner. Each of the statements on this opinionnaire expresses a feeling which a particular person has toward mathematics. You are to express, on a five-point scale, the extent of agreement between the feeling expressed in each statement and your own personal feeling. The five points are: Strongly Disagree (SD), Disagree (D), Undecided (U), Agree (A), and Strongly Agree (SA). You are to encircle the letter(s) which best indicates how closely you agree or disagree with the feeling expressed in each statement AS IT CONCERNS YOU.

1. I am always under a terrible strain in a math class.

   SD D U A SA

2. I do not like mathematics, and it scares me to have to take it.

   SD D U A SA

3. Mathematics is very interesting to me, and I enjoy math courses.

   SD D U A SA

4. Mathematics is fascinating and fun.

   SD D U A SA

5. Mathematics makes me feel secure, and at the same time it is stimulating.

   SD D U A SA

6. My mind goes blank, and I am unable to think clearly when working math.

   SD D U A SA

7. I feel a sense of insecurity when attempting mathematics.

   SD D U A SA

8. Mathematics makes me feel me feel uncomfortable, restless, irritable and impatient.

   SD D U A SA

9. The feeling that I have toward mathematics is a good feeling.

SD D U A SA

10. Mathematics makes me feel as though I'm lost in a jungle of numbers and can't find my way out.

SD D U A SA

11. Mathematics is something which I enjoy a great deal.

SD D U A SA

12. When I hear the word math, I have a feeling of dislike.

SD D U A SA

13. I approach math with a feeling of hesitation, resulting from a fear of not being able to do math.

SD D U A SA

14. I really like mathematics.

SD D U A SA

15. Mathematics is a course in school which I have always enjoyed studying.

SD D U A SA

16. It makes me nervous to even think about having to do a math problem.

SD D U A SA

17. I have never liked math, and it is my most dreaded subject.

SD D U A SA

18. I am happier in a math class than in any other class.

SD D U A SA

19. I feel at ease in mathematics, and I like it very much.

SD D U A SA

20. I feel a definite positive reaction to mathematics; it's enjoyable.

SD D U A SA

APPENDIX E

DESCRIPTIVE STATISTICS

TABLE 14

DESCRIPTIVE STATISTICS: BASIC COMPUTATIONAL SKILLS TEST SCORES

Treatments		Descriptive Statistics				
		Mean	Standard Deviation	Median	Skewness	Kurtosis
Regular	Pretest	32.24	9.44	34.00	-0.54	2.54
	Posttest	40.80	8.61	43.00	-0.70	2.69
Intern	Pretest	34.47	7.63	35.00	-0.18	2.15
	Posttest	40.39	7.67	41.00	-0.28	3.29
Micro	Pretest	37.43	8.06	37.00	0.57	3.02
	Posttest	40.95	8.35	42.00	-0.02	1.83
Int. & Micro	Pretest	33.42	8.99	33.50	0.18	2.62
	Posttest	38.88	9.27	42.00	-0.41	2.29

1. Correlation of posttest achievement and posttest attitude scores = .47

2. Correlation of pretest and posttest achievement scores = .77

TABLE 15

DESCRIPTIVE STATISTICS: REVISED MATH ATTITUDE SCALE SCORES

Treatments		Descriptive Statistics				
		Mean	Standard Deviation	Median	Skewness	Kurtosis
Regular	Pretest	69.52	12.92	71.00	-0.30	2.05
	Posttest	72.72	16.00	79.00	-0.73	2.64
Intern	Pretest	66.29	13.06	67.00	-0.76	3.06
	Posttest	68.13	14.33	70.00	-0.23	2.34
Micro	Pretest	70.36	17.26	76.00	-1.15	3.87
	Posttest	65.50	21.22	72.50	-0.52	2.15
Int. & Micro	Pretest	65.85	15.18	61.50	0.68	2.43
	Posttest	73.90	15.71	74.00	-0.16	2.10